How To Determine Nitrogen Levels In Irrigation Water

By Brian Whitlark, agronomist, West Region

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Nitrogen in irrigation water may result in puffy turf and scalping.

Understanding nitrogen inputs is critical to managing healthy turf because excessive nitrogen can cause a variety of playability and turf health issues – including puffy turf that is prone to mower scalping. Most superintendents know how much nitrogen is supplied through fertilization, but accounting for the nitrogen supplied through irrigation water can be more challenging. In some cases, nitrogen supplied through irrigation can negate the need for supplemental fertilization during periods of peak water use. Here are some frequently asked questions about nitrogen in irrigation water:

What forms of nitrogen are in the irrigation water?

The majority of nitrogen in irrigation water is nitrate (NO_3^-), but some ammonium (NH_4^+) may also be present. Testing irrigation water for both nitrate and ammonium will help determine the total nitrogen content.

What is the difference between nitrate (NO_3^-) and nitrate-nitrogen (NO_3^- - N) on water tests?

Labs often report nitrogen from nitrate as NO_3^- - N and nitrogen from ammonium as NH_4^+ - N. The values represent the amount of actual nitrogen in the water, not the amount of nitrate or ammonium. On the other hand, some labs report NO_3^- and NH_4^+ content. Values for NO_3^- and NH_4^+ content must be

converted to actual nitrogen using the conversion factors in Table 1. Nitrogen content should be presented in parts per million (ppm), which is equivalent to milligrams per liter (mg/L).

How do you calculate the amount of nitrogen suppled through irrigation water?

Step 1: Multiply the actual nitrogen content of the water by 2.72 to convert from ppm to pounds of nitrogen per acre foot of water.

Step 2: Divide pounds of nitrogen per acre foot of water by 43.56 to determine the pounds of nitrogen supplied per 1,000 square feet for every 1 foot of applied irrigation water.

Step 3: Multiply the pounds of nitrogen supplied per 1,000 square feet for every 1 foot of applied irrigation water by the amount of irrigation applied in acre feet per acre of irrigated turf to calculate the annual amount of nitrogen supplied by irrigation water per 1,000 square feet.

For example, if a course annually applies 300 acre feet of water over 100 acres of turf – i.e., 3 acre feet of water per acre – multiplying the result of Step 2 by 3 yields the annual amount of nitrogen supplied by irrigation per 1,000 square feet.

The same calculation applies to determine the amount of nitrogen applied through irrigation during a particular month.

Sample Calculation:

A water analysis reports that the irrigation water used by a golf course contains 4.66 ppm NO_3^- - N and 1.2 ppm NH_4^+ - N. The course applies 2.9 acre feet of water per acre, per year.

1. The water test provides actual nitrogen content so there is no need to convert nitrate or ammonium to actual nitrogen.

2. Multiply both the nitrate nitrogen (4.66 ppm) and ammonium nitrogen (1.2 ppm) by 2.72 to yield pounds of nitrogen per acre foot of water:

   4.66 x 2.72 = 12.67 pounds of nitrogen per acre foot of water from NO_3^-

   1.2 x 2.72 = 3.26 pounds of nitrogen per acre foot of water from NH_4^+

3. Sum the nitrogen from both sources:

12.67 + 3.26 = 15.93 pounds of nitrogen applied per acre foot of water

4. Divide by 43.56:

15.93 ÷ 43.56 = 0.366 pound nitrogen per 1,000 square feet per 1 foot of water

5. Given that the course annually applies 2.9 acre feet of water per acre, multiply 0.366 by 2.9:

0.366 x 2.9 = 1.06 pounds of actual nitrogen applied by irrigation per 1,000 square feet annually

For assistance with these calculations and specific programs tailored to your course, please contact the USGA Green Section.

West Region Agronomists:

Patrick J. Gross, regional director – pgross@usga.org

Larry W. Gilhuly, agronomist – lgilhuly@usga.org

Brian S. Whitlark, agronomist – bwhitlark@usga.org

Blake Meentemeyer, agronomist – bmeentemeyer@usga.org

Information on the USGA's Course Consulting Service

Contact the Green Section Staff